IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Robert Socha et al.

Serial No.: 10/756,829

Filed: January 14, 2004

For: Method of Optical Proximity Correction Design for Contact Hole Mask

Confirmation No. 2388

Examiner: Suresh Memula
Art Unit: 2825
Atty. Docket No.: 81468-370191
P-1510.010-US

Filed electronically via EFS.

PRE-APPEAL BRIEF REQUEST FOR REVIEW

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants request review of the Final Office Action mailed September 26, 2008 for which a response was filed on December 2, 2008. Pursuant to the Advisory Action mailed January 15, 2009, the period for reply expired on December 25, 2008, and a reply is currently due January 25, 2009 (Jan. 25 = Sun., Jan. 26 = Mon.).

Petition for Extension of Time: Applicants respectfully petition under Rule 136 for a one-month extension of time to cover the filing of this paper, and for which a fee under Rule 17 of $120.00 is estimated. This request is being filed with a Notice of Appeal under Rule 191, and Notice of Appeal is hereby given. The review is requested for the reason(s) stated hereinbelow. The Commissioner is authorized to charge the extension fee, Notice of Appeal fee, and any other required fee(s) or to credit any overpayments to Pillsbury Winthrop Shaw Pittman LLP's deposit account no. 03-3975 (order no. 081468-0370191).

No amendments are being filed with this request. Applicants restate and incorporate herein remarks previously made in response to the pending rejections. Claims 1-22 are pending in the application, with claims 8-9 and 12-18 having been withdrawn from consideration. More particularly for purposes of this Brief, independent claim 1 (from which claims 2-7 and 19-20 depend) and independent claim 10 (from which claims 11 and 22 depend) stand rejected under

35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,263,299 to Aleshin et al. ("Aleshin") in view of U.S. Patent Pub. No. 2002/0062206 to Liebchen ("Liebchen").

Independent claims 1 and 10 set forth a method aimed at, for example, optimizing an illumination profile so as to improve the printability of certain types of resolvable features in a mask (e.g. subwavelength contact holes). Claims 1 and 10 require, inter alia:

> representing at least one resolvable feature of a mask to be printed on the substrate by at least one impulse function; and
> creating an interference map based on the at least one impulse function and the TCC function, wherein the interference map represents the at least one resolvable feature to be printed on the substrate and areas of destructive interference.

The Examiner primarily relies on Aleshin as suggesting this claimed subject matter, and so the arguments below will focus on Aleshin. Applicants respectfully submit that the Examiner's positions regarding this reference are based on focusing on claim terms in isolation while ignoring the claimed invention as a whole, contrary to what is required under § 103.

More particularly, Aleshin expressly teaches in col. 11 that mask patterns are decomposed into polygons or rectangles bounded by vertices (i.e. points) in the mask plane for use in aerial image simulation. For example, Aleshin teaches that rectangles of features in the mask plane are defined by edges having coordinates x1, x2, y1, y2, where x1<x2 and y1<y2. Accordingly, Aleshin expressly teaches that features are represented by one or more rectangles or polygons each having at least four points in the mask plane.

Applicants respectfully submit that these rectangles and polygons would likely viewed by one skilled in the art as representations or decompositions of resolvable features, rather than resolvable features themselves. However, for the sake of argument herein, they will be assumed to correspond to the claimed resolvable features. These rectangular/polygon representations are used in the subsequent equations 4, 6 and 7 in cols. 11 and 12 of Aleshin for aerial image simulation. As is well understood in the art, aerial image simulation aims at estimating light intensities impinging on a substrate when a mask is illuminated by a given illumination source.

Accordingly, as compared to the claimed invention as a whole, Aleshin fairly describes decomposing patterns in a mask into rectangles and polygons, and performing aerial image simulation using these decomposed rectangles and polygons.

Applicants' previous responses have demonstrated that Aleshin does not further disclose or suggest the claimed step of representing these rectangles and polygons by one or more impulse functions or the claimed step of creating an interference map that, among other things, "represents the at least one resolvable feature to be printed on the substrate [i.e. the rectangles and polygons] and areas of destructive interference."

As for the claimed step of representing a resolvable feature in a mask by at least one impulse function, the Final Office Action pointed to col. 3 of Aleshin and stated that "The points where the pattern will appear on the chip are resolvable features and are represented with an amplitude of one, i.e., impulse response; whereas points where no pattern will appear are represented with an amplitude of zero (Col. 3, lines 59-62)." Applicants showed how Aleshin here is really teaching about representing features with rectangles and polygons comprising many contiguous points of amplitude one, and so they are different from impulse functions. Applicants further showed how col. 5 of Aleshin, also relied on by the Office Action, merely described conventional Hopkins analysis that includes using a coherent impulse response function of the optical system, rather than representing features in a mask.

In response, the Advisory Action stated that "Applicant's claim recited 'impulse function' does not necessitate a difference over an impulse response function." Applicants respectfully disagree. Those skilled in the art understand the profound differences between an impulse function and an impulse response function (i.e. a function representing the response of a system to an impulse).

The Advisory Action further stated that " In any event, even an impulse response function is an output of an impulse function, so a particular feature represented by an impulse response function is inherently represented by the corresponding impulse function."

Applicants respectfully submit that the Examiner's reliance on this inherency theory is misplaced. Moreover, Applicants respectfully submit that the Examiner is focusing too much on words in abstract isolation and is ignoring the context of their use in the claim as a whole. This strained position would also render meaningless the claimed step of further creating an interference map that represents the resolvable feature to be printed on the substrate.

First, it is irrelevant that impulse response functions are axiomatically defined by input impulse functions. Just because an impulse response function is defined by an input impulse function does not suggest that every Hopkins function as disclosed by Aleshin is necessarily the

3

result of a resolvable feature being represented by an impulse function as set forth in the claims. On the contrary, the prior art is replete with references to Hopkins functions that do not include resolvable features being represented by impulse functions, and the Examiner correctly fails to state anything to the contrary. Accordingly, the inherency theory set forth in the Advisory Action is inapposite to the instant claims as a whole and the rejections thereof.

Moreover, the Applicants respectfully note that it is the Examiner's burden to show that the cited prior art teaches or suggests every limitation of the claims, as they are reasonably construed. It is not for the Applicant to disprove every possible hypothetical construction of individual words in the claims in isolation.

Along these lines, the claim requires representing a resolvable feature by at least one impulse function, and then generating an interference map based on the impulse function. Accordingly, the claims require that the impulse function that represents the resolvable feature is used to generate an interference map. If the Examiner is relying on the impulse response function as inherently disclosing the step of representing the resolvable feature by an impulse function, it is impermissible to also rely on this impulse response function as meeting the claimed step of generating the interference map. More particularly, since Aleshin discloses using Hopkins functions (which include impulse response functions) to generate the aerial image, it is impermissible to rely on Aleshin's aerial image generation as meeting both the claimed steps of representing resolvable feature by impulse functions and generating the interference map (which allegedly includes the impulse response function). To do so would render either of these claimed steps meaningless.

As for the claimed step of creating an interference map, the Final Office Action stated that Aleshin's aerial image "represents the printability of resolvable features in terms of areas of light intensity distributions." Applicants do not dispute this, because this is a well known aspect of most simulated aerial images. However, Applicants respectfully disagree that Aleshin's aerial image further represents areas of destructive interference as required by the claims. The claimed areas of destructive interference are distinct and in addition to the image of the resolvable feature. Aleshin does not disclose or suggest generating a map of how anything else besides the resolvable features will appear at the substrate plane.

The Advisory Action further stated that "an aerial image, i.e., interference map, predicts mask feature printability and identifies critical areas." This may be true, but it is irrelevant to the

claimed areas of destructive interference, which are separate from the printable features. A simulated aerial image only predicts how <u>features</u> will or will not print. On the other hand, the claimed interference map further represents areas of destructive interference. Aleshin's silence regarding any additional contents of the aerial image cannot be transformed into a teaching that is used to support a rejection.
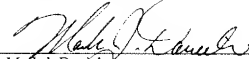
For at least these reasons, independent claims 1 and 10 patentably define over the cited prior art, and the 103 rejection of the claims should be withdrawn.

CONCLUSION

For at least the reasons presented above, it is respectfully submitted that the present rejections are improper. Further, the claims are believed to be in form for allowance, and Notice thereof is hereby solicited.

Respectfully submitted,
PILLSBURY WINTHROP-SHAW PITTMAN LLP

Date: January 26, 2009   40,580
                                                          Registration No.
Mark J. Danielson
650-233-4077
Please reply to Customer No. 27,498